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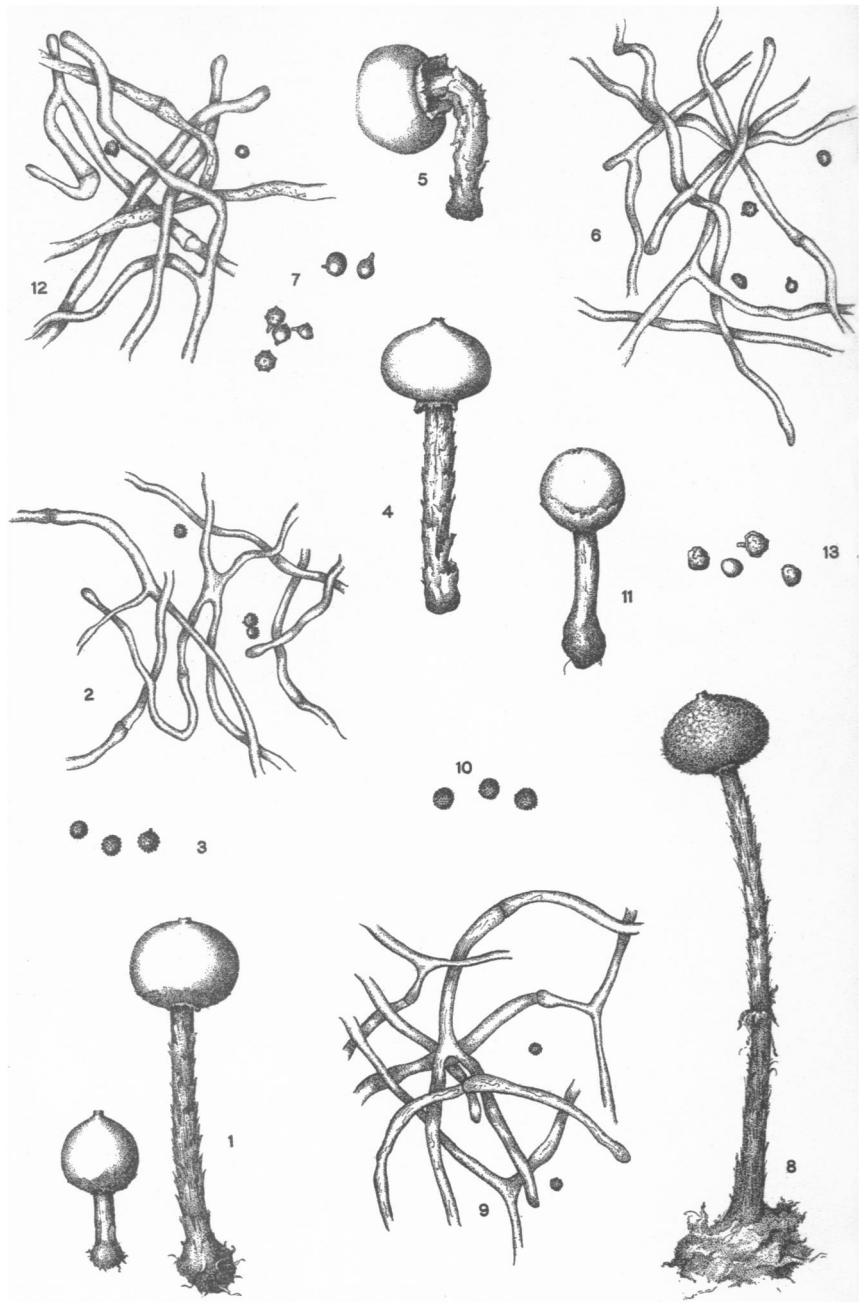
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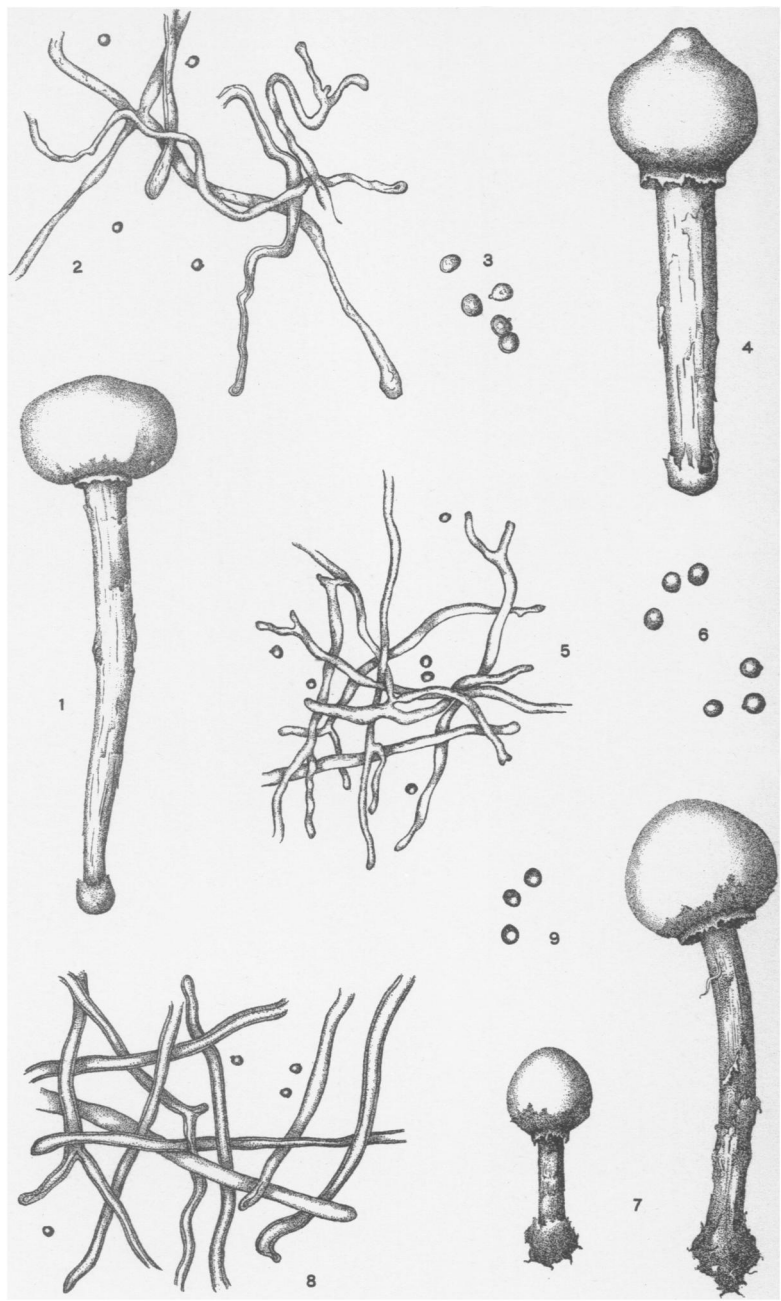
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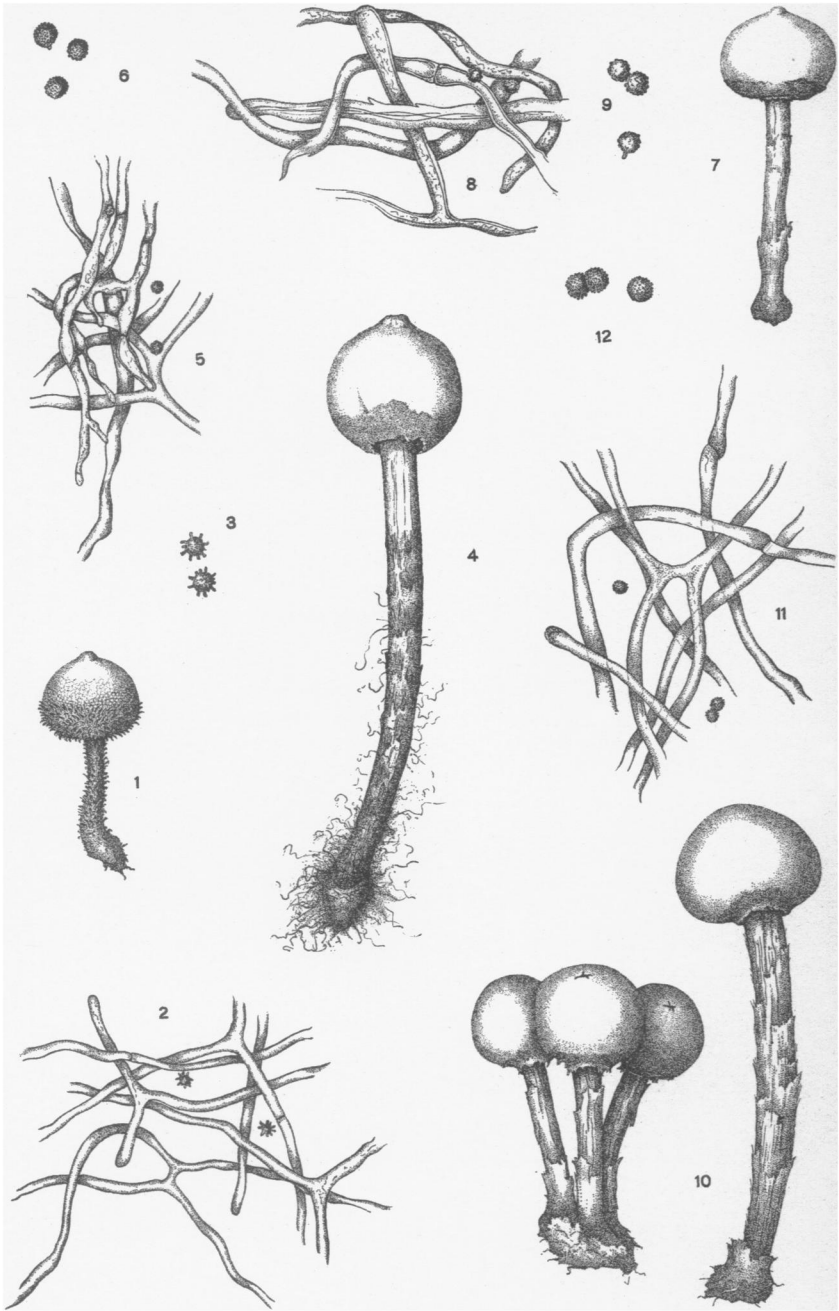
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TYLOSTOMA



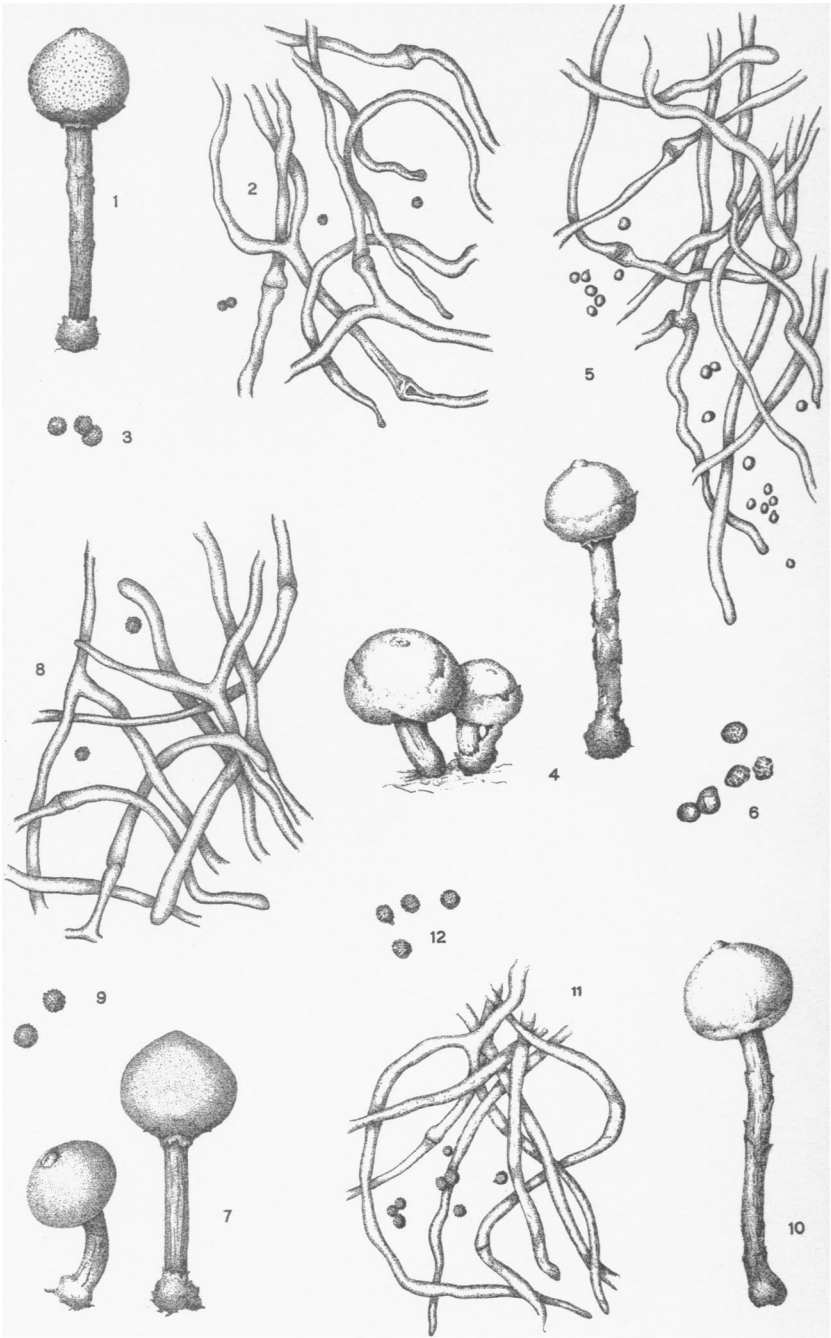
TYLOSTOMA

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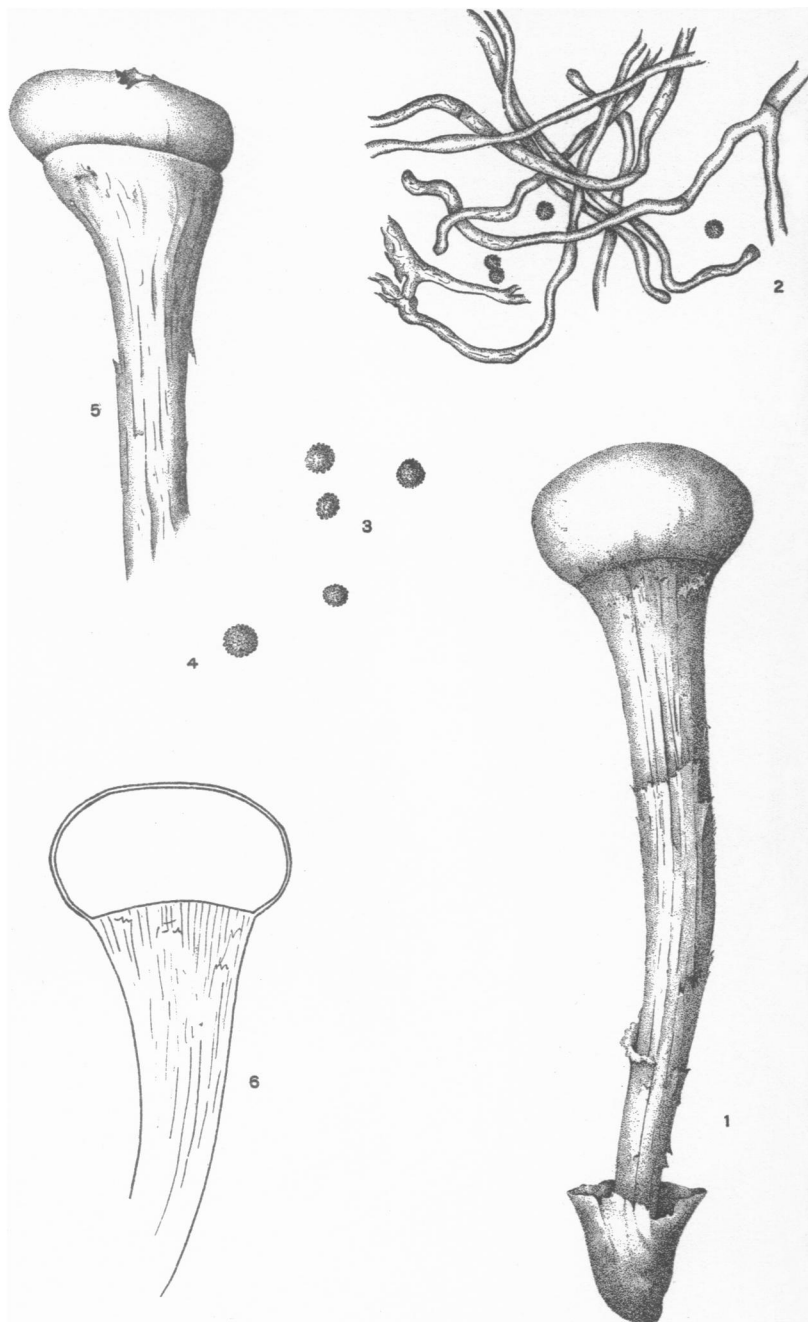
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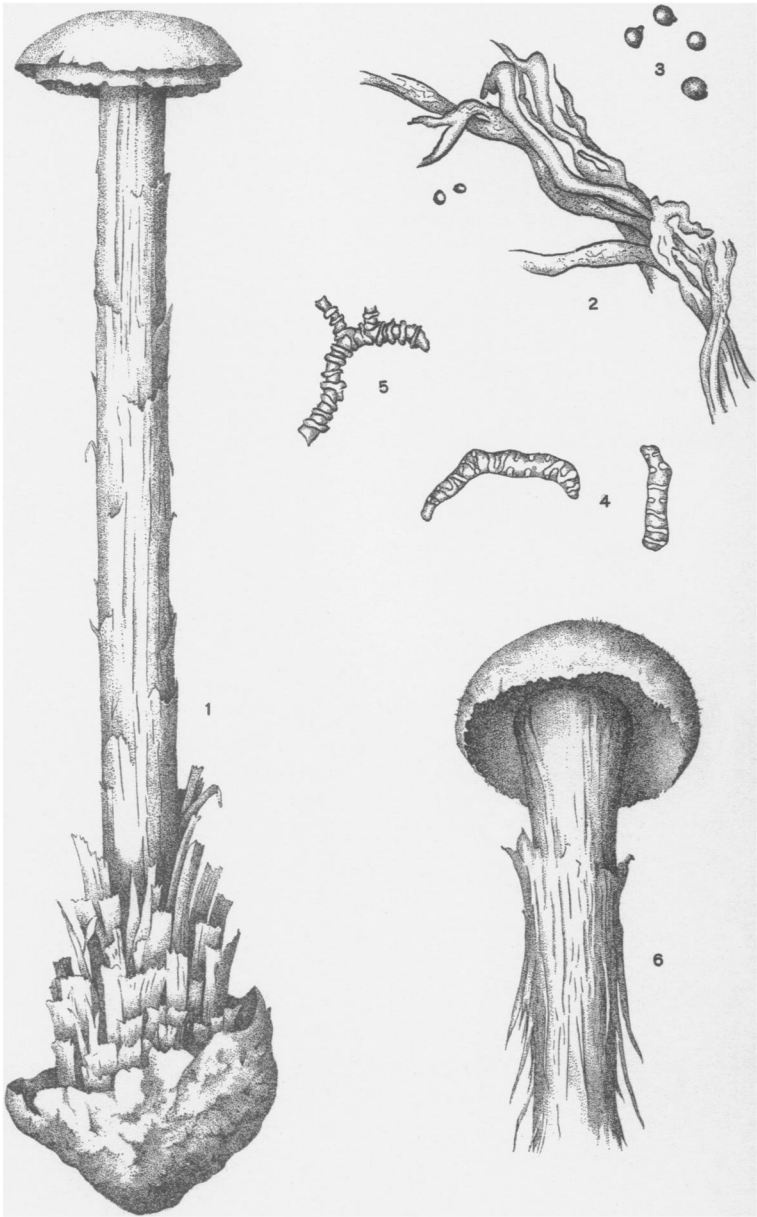
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TYLOSTOMA



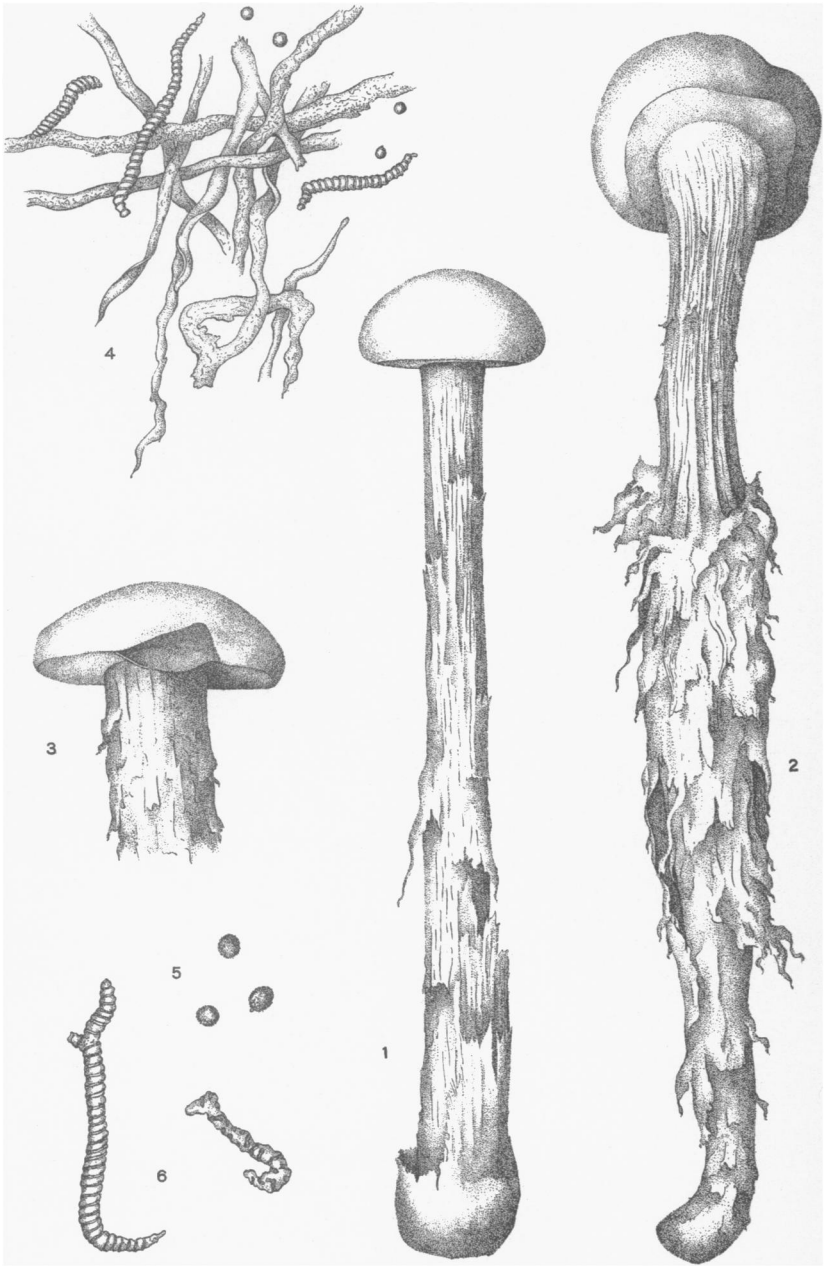
CHLAMYDOPUS

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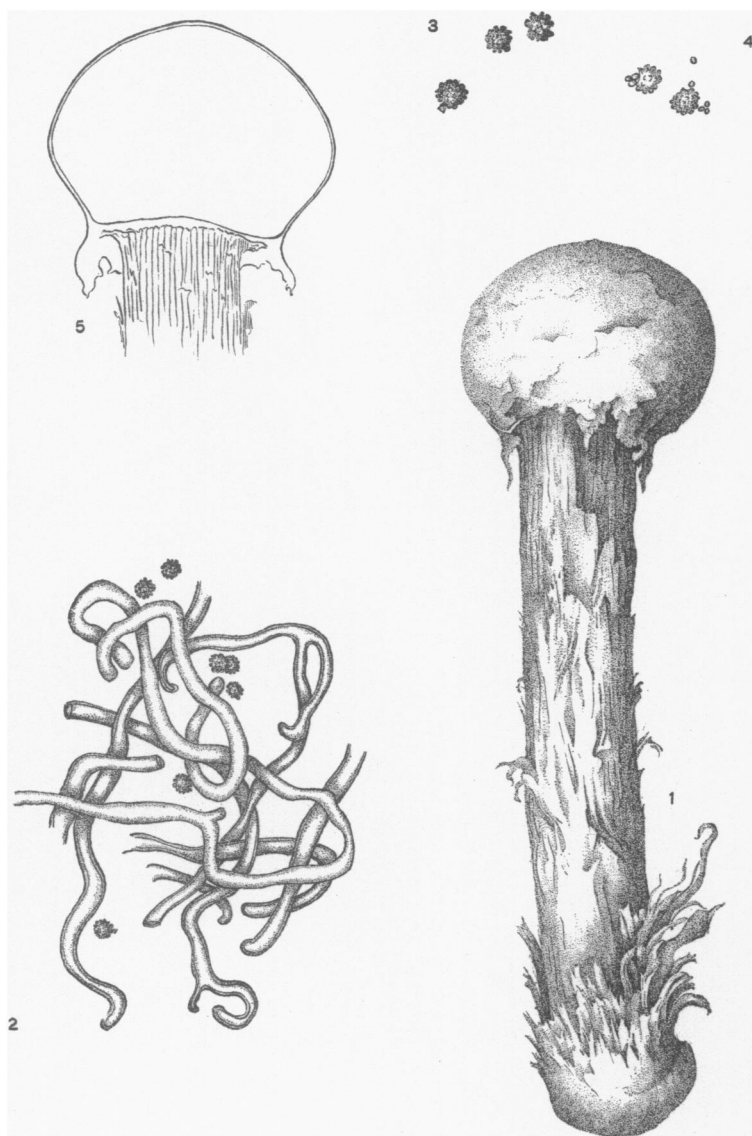
BATTARREA



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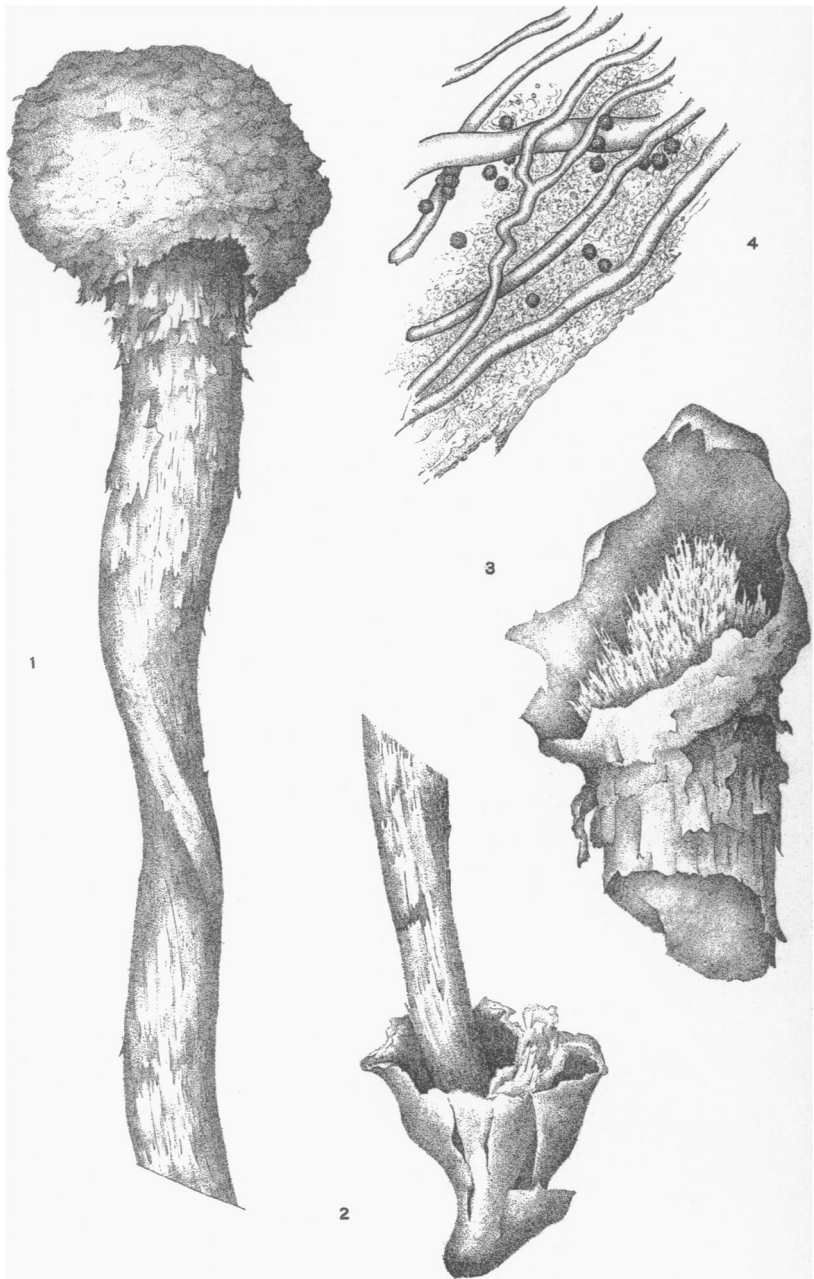
BATTARREA





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QUELETIA



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DICTYOCEPHALOS



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DICTYOCEPHALOS

BULLETIN  
OF THE  
TORREY BOTANICAL CLUB

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AUGUST 1901

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The Tylostomaceae of North America

BY V. S. WHITE

(WITH PLATES 31-40)

The members of this family are puffball-like plants, which form underground in the shape of rounded masses, appearing at first on the mycelium as minute thickenings, and gradually reaching their full development. The ball has a thick outer covering, and an inner, and usually thinner one, commonly known as the peridium proper. The upper and larger portion of the ball is composed of sporogenous tissue, and there is a lower sterile portion which elongates when conditions are most favorable, forcing the upper portion up through the surface of the ground, and consequently rupturing the outer coat which originally enveloped the whole mass. In some genera this outer coat remains at the base as a distinct cup-like volva, the upper portion then being carried up almost intact and falling away or adhering to the peridium; in other cases the outer coat is ruptured irregularly, bearing very slight traces at the base of the stem or even none at all, and in the genus *Tylostoma* this coat adheres more or less to the peridium, nearly always leaving some traces in the form of a collar at its base. The stem is commonly of a firm, almost woody texture, and the plants can be quite satisfactorily preserved in a dry condition. They vary greatly as to size and shape, but are all constructed on the same general plan, having a more or less irregularly globose peridium, and a distinct footstalk, which is usually, though not always, more than twice the length of the peridium in mature forms. The methods of

dehiscence are very different in the various genera, some having a definite apical mouth, the peridium withering and collapsing as the spores escape; others rupture irregularly from above downwards, more as in the Sclerodermataceae. *Battarrea* has a regular line of dehiscence where the upper portion of the somewhat hemispheric peridium breaks away, leaving the lower portion at the summit of the long stem.

In the peridial characters, *Tylostoma* is closely allied to the Lycoperdaceae. The relation of this family to the Phallaceae is one of analogy mainly, shown in the elongation of the stem which forces the spore-bearing parts to a higher position for the better scattering of the spores.

In his latest treatment of the family, Fischer\* recognizes four genera: *Tylostoma* with forty species, widely distributed; *Queletia* with a single species from France, failing to note that it had also been reported from America; *Battarrea* with eight species; and *Sphaericeps* with one species from Angola. The genus *Chlamydopus*, described by Spegazzini† from Argentina, after Fischer's first draft was prepared, was later too summarily assigned as a synonym of *Tylostoma*,‡ for the differences are so marked that it would be unfortunate to include these two diverse types under one genus.

Within the past year several specimens of a *Chlamydopus* have been found at Mesilla Park, New Mexico, and it was the original purpose of this paper simply to describe and figure these. It soon became necessary to study the members of the allied genus *Tylostoma*, of which extensive suites of specimens were found in the Ellis collection, mainly from the western half of the country, representing some species hitherto undescribed, so that it was finally concluded to prepare a revision of the entire family as represented in North America. Finally some specimens collected by Mr. E. Bethel, of Denver, Colorado, and sent by him to Mr. Ellis, proved to belong to an undescribed genus. This large amount of material, mostly forming a part of the Ellis collection at the New York Botanical Garden has made the preparation of this paper

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\* Engler & Prantl, Die nat. Pflanzenfam. 1<sup>1</sup>\*\* : 342. 1900.

† An. Mus. Nac. Buenos Aires, 6 : pl. 4. f. 2, 3. 1899.

‡ Engler & Prantl, Die nat. Pflanzenfam. 1<sup>1</sup>\*\* : 357. 1900.

possible. Mr. E. Bartholomew has kindly loaned material, for the better description of one species, and Mr. E. S. Salmon has kindly looked up some data at Kew, England.

Special thanks are due to Professor Charles H. Peck, of Albany, for material and suggestions, and more especially to Professor L. M. Underwood, of Columbia University, under whose direction the work has been undertaken and whose private collection has furnished considerable additional material.

The genera of the family Tylostomaceae may be recognized by the following synopsis:

Peridium opening by an apical mouth.

Peridium with a collar underneath, formed about the cylindrical stem; volva indefinite. I. TYLOSTOMA

Peridium without a collar; stem much enlarged where it joins the peridium; volva cup-like, flaring. II. CHLAMYDOPUS

Peridium circumscissile.

Peridium hemispheric or nearly plane below, dehiscing at the margin of the plane of the hemisphere. III. BATTARREA

Peridium spherical, dehiscing at the equator. SPHAERICEPS (extra-limital).

Peridium opening irregularly.

Peridium readily separating from the stem; capillitium free.

IV. QUELETIA

Peridium closely attached to the stalk; capillitium embedded in a membranous tissue. V. DICTYOCEPHALOS

# I. TYLOSTOMA Pers. Römer, Neues Mag. Bot. 1: 86. 1794

The first reference to a plant certainly belonging to *Tylostoma*, is to be found as early as 1696, in Ray's Synopsis\* under the name of *Fungus pulverulentus minimus*. He describes it in a few Latin words, "Pediculo longo, insidens. In agris circa Londinum," and adds in English, "the least dusty mushroom, with a long foot-stalk, collected by D. Tancred Robinson, M.D." The next mention is made in 1700 by Tournefort† who also gives the first figure of a *Tylostoma*; this has the characteristic short tubular mouth of *T. pedunculatum*, a slender, smooth stem, and closely resembles specimens of this plant found in our own country. Micheli‡ next figured the other variety of *T. pedunculatum* under the name, *squamosum*. This figure is not so easy to identify as that of Tournefort;

\* Syn. Meth. Stirp. Brit. 2d ed., 16. 1696.

† Inst. rei Herb. 1: 563. pl. 331. f. E, F. 1700.

‡ Nova Plantarum Genera, 218, nos. 10 and 11. pl. 97. f. 1. 1729.

none of the European specimens of this variety seen, have such a rough stem, or a peridium of the exact shape as shown in the figure, but it is evident notwithstanding, what it was meant to represent. *T. pedunculatum* being the commonest European species, and widely distributed tends to vary and extreme specimens are found to differ so widely that were it not for the many intermediate stages, the extremes might well be kept distinct, as indeed has been done by several writers.

Linnaeus\* refers to this same plant by its first binomial, *Lycoperdon pedunculatum*, and cites the above-mentioned descriptions of Ray and Tournefort. His description is in the following words: "Stipite longo, capitulo globoso glabro; ore cylindrico, integerrimo. Habitat in campestribus." In 1794 Persoon established the genus *Tylostoma*.† He described it—"Peridium stipitatum, ore cylindrico cartilagineo"—and mentions two species *T. brumale* (*L. pedunculatum* L.) and *T. imbricatum* (Micheli Ly. 11); these two species have since been commonly referred to, under the name of *T. mammosum* (Mich.) Fries, but all these specific names are antedated by *pedunculatum* of Linnaeus.

Since the time of Persoon, various species of *Tylostoma* have been described, and De Toni‡ enumerates thirty-four species from different parts of the world.

Our own species were studied in 1890 by Morgan,§ but evidently from a limited amount of material. In his paper he enumerates five species, of which *T. mammosum* and *T. fimbriatum* are originally European, two were new native species, *T. verrucosum* and *T. campestre*, and the fifth he called *T. Meyenianum* Kl., but it is evident that the original *T. Meyenianum* was not a true *Tylostoma* but a poorly figured species of the genus *Chlamydomys*, and as the material on which Morgan based his determination is not now available, we are uncertain as to what his last species really is. *T. pedunculatum* was first reported from this country in 1818|| by Schweinitz|| under the name

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\* Sp. Plant. 1184. 1753.

† *Tylostoma* from *τυλος*, callous skin, and *στομα*, a mouth.

‡ Saccardo, Syll. Fung. 7: 60; 9: 268; 11: 159; 14: 258.

§ Jour. Cin. Soc. Nat. Hist. 12: 163; pl. 16. f. 1-5. 1890.

|| Syn. Fung. Car. 34. 1818.

of *T. brumale* Pers. from North Carolina, and in 1834\* he gives two species, *T. brumale* and *T. squamulosum*,† of which latter he writes “not a variety of the preceding but closely resembling *Rinella* of Rafinesque,‡” but notwithstanding his assertion to the contrary *T. squamosum* is now commonly regarded as a variety of *T. pedunculatum* (*brumale*). In 1837, Montagne§ described *T. exasperatum* from Cuba, collected by Ramon de la Sagra, the well-known Cuban naturalist, and this species has since been reported from India. In 1867 Curtis¶ mentions *T. fimbriatum* and *T. mammosum* as “common in North Carolina,” and six years later Berkeley\*\* reported *T. fimbriatum*, *T. mammosum*, and *T. Meyenianum*, collected by Wright in New Mexico. As late as 1891, Massee†† published Berkeley’s description of *T. Wrightii*, also from New Mexico. Other American species have been described since, *T. obesum* C. & E., ‡‡ *T. punctatum* Peck, §§ and *T. semisulcatum* Peck. ¶¶ Much of the western material found in the Ellis collection had been referred to *T. obesum*, although it represents very diverse forms. *T. punctatum* has been reported from several localities, but of *T. semisulcatum* only the type specimens are known, and these are inaccessible at Albany, if indeed they are still in existence. Extensive collections have been made in different parts of the United States in the past few years and we

\* Trans. Amer. Phil. Soc. 4: 256. 1834.

† Since writing the above it has been possible to examine Schweinitz’ original specimens, which are carefully preserved in the Philadelphia Academy of Natural Sciences. There is a question as to the specimen marked *T. brumale* being *T. pedunculatum*, to which it is usually referred, owing to the color of the peridium, which is a bright terra-cotta red, unlike anything seen before—but this may be due to the color of the clay in which the plant grew or to other causes of unknown origin. The specimen marked *T. squamosum* resembles greatly some of our specimens of *T. fimbriatum* in general habit and spore characters, with the exception of the mouth which is entire, but not tubular and prominent, like the mouth of *T. pedunculatum*—which fact may be owing to the wasting of the cartilaginous tissues occasioned by time—so that it is hardly possible to determine what this plant really was.

‡ Syst. F. Veg. 139.

§ Ann. Sci. Nat. II. 8: 362. 1837.

¶ Geol. and Nat. Hist. Survey North Carolina, 3: 110. 1867.

\*\* Grevillea 2: 49. 1873.

†† Grevillea 19: 95. 1891.

‡‡ Grevillea 6: 82, pl. 100. f. 24. 1878.

§§ Bull. Torr. Club, 23: 419. 1896.

¶¶ Bull. Torr. Club, 22: 209. 1895.



find among them several additional species. The indications are that we are only at the beginning of our knowledge of their distribution.

The following table shows the distribution of the hitherto known species of *Tylostoma* :

TYLOSTOMA.	North America.	South America.	Europe.	Asia.	Africa.	Australia.	Mexico and Central America.	Borneo.	Sandwich Islands.
album.						+			
Angolense.				+	+				
Barlae.			+	+					
Barbeyanum.				+					
Berteroanum.		+		+					
Bonianum.				+	+				
Bossieri.									
campestre.	+								
caespitosum.				+					
carneum.					+				
Cesatii.				+					
exasperatum.	+			+					
fimbriatum.	+		+			+			
Giovanellae.			+						
granulosum.			+						
Jourdani.					+				
laceratum.					+				
leprosum.						+			
Leveilleanum.									
mammosum.	+		+	+	+	+	+		+
maximum.						+			
Mollerianum.					+				
montanum.					+				
obesum.	+								
pulchellum.					+				
pusillum.		+						+	
Patagonicum.		+							
Schweinfurthi.					+				
squamosum.					+				
tortuosum.					+				
volvulatum.				+					
verrucosum.	+								
Wightii.				+					
Wrightii.	+								

The species of *Tylostoma* are found principally in sandy regions, in dry barren fields, rarely in woods or shaded places. As yet very little is known of their habits, growth and development as no little difficulty attends the study of these strange and interesting plants in their early subterranean stages. It is hoped that stu-

dents in the districts where these plants are most common will gather material in the earlier stages of growth—digging down where mature forms are found above ground in the hope of finding the young peridia.

As far as can be ascertained, only two papers have appeared treating of the growth of these plants. Schroeter \* has published an account of the development of the spores and basidia. Professor Bessey † has a short note on the growth of *T. mammosum* in which he says, "The ball forms underground, and reaches maturity there so far as the spores are concerned. *Tylostoma* agrees with *Lycoperdon* in having the interior of the ball composed of two portions, first a spore-bearing part which occupies most of the interior, and second a sterile base composed of tissue which does not produce spores. In *Tylostoma* a portion of this tissue of the sterile base remains living until the spores ripen. Then this tissue begins a rapid growth and a cylindrical stalk is produced which forces the ball through the overlying earth and carries it up several inches." Massee, ‡ speaking of *Tylostoma mammosum* says, "resembling a *Lycoperdon* with an elongated stem, but readily distinguished by the groove between the apex of the stem and the peridium, and by the threads of the capillitium being nodulose at the base of the septa." And writing of the stem, "it is sometimes smooth, and at others broken with small irregular fibrillose squamules which are sometimes arranged more or less in circles."

#### Synopsis of our Species

Mouth entire, short tubular.

Spores smooth, or occasionally with a few minute scattered warts.

1. *T. albicans.*

Spores uniformly and densely verrucose.

Peridium smooth; capillitium not much swollen at the joints.

2. *T. pedunculatum.*

Peridium warty; capillitium swollen at the joints.

3. *T. verrucosum.*

Mouth lacerate-fimbriate, not tubular.

Spores smooth or nearly so.

Mouth plane.

Stem tapering toward the base; peridium depressed.

4. *T. gracile.*

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\* Cohn's Beitr. Biol. Pflanz. 2: 65. 1877.

† Amer. Nat. 21: 665. 1887.

‡ Ann. Bot. 4: 85. 1889.

- Stem not tapering; peridium globose.  
 Capillitium freely septate; stem short (1-1.5 cm.), collar close.  
 5. *T. minutum*.  
 Capillitium rarely or never septate; stem longer (1.5-5 cm.), collar distant.  
 6. *T. Kansense*.  
 Mouth raised, convex.  
 Capillitium freely septate; outer peridium long persistent.  
 7. *T. poculatum*.  
 Capillitium rarely or never septate; outer peridium soon receding.  
 8. *T. obesum*.  
 Spores verrucose or granular.  
 Mouth plane.  
 9. *T. campestre*.  
 Mouth raised, convex.  
 Spores furnished with long blunt spinules; stem short (0.75 cm.), rough spiny.  
 10. *T. exasperatum*.  
 Spores with coarse scattered tubercles; stem longer (3 cm.), even, nearly smooth.  
 11. *T. tuberculatum*.  
 Spores finely granulate-verrucose.  
 Capillitium sparingly septate, not much swollen at the joints.  
 Stem elongate (6 cm.), with copious persistent mycelial strands.  
 12. *T. fibrillosum*.  
 Stem shorter (3.5 cm.), without mycelial strands.  
 13. *T. subfuscum*.  
 Capillitium freely septate, swollen at the joints.  
 Peridium smooth; mouth fimbriate.  
 14. *T. fimbriatum*.  
 Peridium pitted; mouth lacerate.  
 15. *T. punctatum*.

### 1. *Tylostoma albicans* sp. nov.

Peridium depressed globose, 0.7-1 cm. high, 1-1.5 cm. in diameter: outer peridium scaly, retreating and leaving a smooth whitish surface to the inner membranaceous peridium: mouth short tubular, entire, prominent: collar irregular, 3-5 mm. distant from the stem: stem equal, slightly thickened at the base, the outer coating lacerate scaly, whitish like the peridium, 4-6 cm. long, 0.5 cm. in diameter: capillitium whitish, hyaline, branched, septate, slightly swollen at the joints, 4-6  $\mu$  wide, free ends rounded: spores reddish brown, irregularly globose, pedicled, smooth, or if rough only a very few of them so, 4-5  $\mu$  in diameter. (Pl. 31, f. 4-7.)

TEXAS: *E. D. Cope*.

2. *TYLOSTOMA PEDUNCULATUM* (L.) Schroeter; Cohn, Beitr. Biol. Pfl. 2: 65. 1877

*Lycoperdon pedunculatum* L. Sp. Pl. 1184. 1753.

*Tulostoma brumale* Pers. Römer Neues Mag. Bot. 1: 86. 1794.

*Tulostoma mammosum* Fr. Syst. 3: 42. 1829.

*Lycoperdon* II. Mich. Nov. Plant. Gen. 218. 1729.

*Tulostoma imbricatum* Pers. Römer Neues Mag. Bot. 1: 86. 1794.

*Lycoperdon squamosum* Gmel. Syst. Nat. 2: 1462. 1796.

*Tulostoma squamosum* Pers. Syn. Meth. Fung. 139. 1801.

*Tulostoma mammosum* Fr. Syst. 3: 42. 1829.

*Tylostoma mammosum* var. *squamosum* De Toni; Saccardo, Syll. Fung. 7: 61. 1888.

Peridium subglobose, 1-1.5 cm. high, 1-2 cm. in diameter, the brown outer peridium soon retreating, leaving the inner peridium smooth and membranaceous: mouth short tubular, entire, prominent: collar inconspicuous: stem slender, lacerate scaly, or nearly smooth, with a small mycelial bulb, stuffed with loose silky threads, 1-5 cm. long, 2.5 mm. in diameter: capillitium 4-7  $\mu$  thick, septate, somewhat swollen at the joints, light colored, hyaline: spores subglobose, 3-5  $\mu$  in diameter, minutely verrucose, some short pedicled. (Pl. 31, f. 1-3.)

*Exsicc.* E. & E. N. A. Fungi 2734 (as *T. mammosum*). Ravenel, Fungi Am. Ex. 137 (as *T. mammosum*).

NEW YORK, *Underwood, Fischer*; NEW JERSEY, *Ellis*; PENNSYLVANIA; MICHIGAN, *McBride*; WISCONSIN, *D. V. B*; NORTH CAROLINA, *Curtis, Wood*; KANSAS, *Kellerman*, 770; INDIANA, *Cook, Underwood*; FLORIDA, *Underwood*; NEBRASKA, *Webber*; TEXAS, *Harris*; COLORADO; IOWA; NEW MEXICO, *Wright, Fendler, Cockrell*; MEXICO, *C. L. Smith*.

3. TYLOSTOMA VERRUCOSUM Morg. Jour. Cin. Soc. Nat. Hist. 12: 163. pl. 16. f. 2. 1890

Peridium depressed globose, 1-1.2 cm. high, 1-1.5 cm. in diameter: outer peridium of scales and warts persistent: inner peridium brownish, becoming smooth with age: mouth entire, raised, prominent, short tubular: collar of delicate lacerate points descending about the top of the stem: stem 4-5 cm. long, .5 cm. in diameter, slender, the surface lacerate scaly, brown, hollow, cylindrical and having a large basal bulb composed of the mycelial strands and adherent earth: capillitium almost white, hyaline, slender, septate, some of the joints rather swollen, 3-6  $\mu$  wide: spores subglobose, granular, lightish cinnamon-colored, 4-7  $\mu$  in diameter. (Pl. 31, f. 8-10.)

OHIO: *Morgan, C. G. Lloyd*.

Growing on the ground in rich soil in woods. The mycelial bulb is usually larger than the peridium.

4. **Tylostoma gracile** sp. nov.

Peridium depressed globose, 1–1.5 cm. high, 1.5–2 cm. in diameter: outer peridium retreating, leaving but slight traces on the inner peridium which is thin, smooth, whitish and rather shiny: mouth plane, lacerate: collar entire, restricted around the top of the stem: stem slender, 3–5.5 cm. long, 6 mm. in diameter at the top, 3 mm. in diameter at the base which is slightly enlarged, somewhat sulcate, lacerate, whitish within and without, fibrillose stuffed, becoming hollow: capillitium dark ferruginous, 4–6  $\mu$  wide, ends rounded, and having swollen places mostly near the ends, branched, rather thick-walled, many threads flattened, septa very scarce: spores subglobose, 3–5  $\mu$  in diameter, smooth, short pediceled. (Pl. 32, f. 1–3.)

NEW MEXICO: Las Cruces, *Wooton*.

5. **Tylostoma minutum** sp. nov.

Peridium globose, 0.7–1 cm. high, 0.7–1.2 cm. in diameter; outer peridium scaly, retreating, leaving smooth, brownish surface to the thin inner peridium, remnants of the outer peridium forming a cup around the base of the inner peridium: mouth plane, fimbriate, small; collar entire, indistinct: stem 1.5–2 cm. long, 3 mm. in diameter at the top, 5 mm. in diameter at the base, slender, slightly enlarged at the base, hollow, fibrillose stuffed: capillitium yellowish, hyaline, sparingly branched, rather thin walled, ends rounded, septa swollen at the joints, 3–5  $\mu$  wide: spores irregularly globose, nearly smooth, pediceled, thick-walled, 3–5  $\mu$  in diameter. (Pl. 31, f. 11–13.)

COLORADO, *Bethel* (type); KANSAS, *Kellerman*.

6. **Tylostoma Kansense** Peck, sp. nov.

Peridium subglobose, 1–2 cm. broad, 1–1.5 cm. high, thick, firm, glabrous, white, somewhat flattened at the base: mouth slightly lacerate on the margin, plane, sometimes slightly prominent: collar wide, membranaceous, 2.5 mm. distant from the stem: stem equal or slightly narrowed toward the base, 1.5–7 cm. long, 6–8 mm. thick, hollow or stuffed with silky fibrils, somewhat sulcate-striate, white within and without, slightly and abruptly bulbous: capillitium sparingly branched, colored, 7–11  $\mu$  wide, hyaline, septa not seen: spores subglobose, 4–5  $\mu$  in diameter, brownish ferruginous. (Pl. 32, f. 7–9.)

KANSAS, *Bartholomew*. July. It has rarely two ostiola.

7. *Tylostoma poculatum* sp. nov.

Peridium globose, somewhat depressed, 1–1.5 cm. high, 1–2 cm. in diameter, smooth, fawn-colored, membranaceous: outer peridium scaly, but more persistent than in most species, remaining in the shape of a cup-like involucre round the base of the peridium, mouth slightly raised, fimbriate, mostly large: collar entire, inconspicuous: stem 1–3 cm. long, 3–6 mm. in diameter, cylindrical, firm, slightly bulbous, hollow or stuffed, often with considerable remnants of the outer peridium attached: capillitium lightish yellow, sparingly branched, septate, swollen at joints, 4–7  $\mu$  wide, rather thick walled: spores ferruginous, subglobose, smooth, or irregularly ridged in the older specimens, owing to the shrinking of the inner substance, short pedicelled, 4–5  $\mu$  in diameter. (Pl. 34, f. 4–6.)

NEBRASKA: Lone Pine, *Bates*, 462 (type); ALABAMA: Tuskegee, *Carver*; COLORADO: Boulder, *D. M. Andrews*. Plants growing singly or in groups of twos and threes.

8. TYLOSTOMA OBESUM C. & E. Grevillea 6: 82. *pl.* 100. *f.* 24.

1878

Peridium globose pyriform, 2.2 cm. high, 2 cm. in diameter, smooth, leathery, whitish, with a kid-like finish: outer peridium scaly, retreating, leaving a narrow ring around the lower part of the peridium: collar entire, descending about the stem: mouth raised, lacerate, rather large: stem 4 cm. long, hard, leathery, somewhat sulcate, slightly tapering at the base, 8 mm. in diameter at the top, 5 mm. in diameter at the base: capillitium dark ferruginous, slender, free ends rounded, branched, septa none or very scarce, 3–6  $\mu$  wide: spores globose, smooth, short pedicelled, 3–6  $\mu$  in diameter. (Pl. 32, f. 4–6.)

COLORADO.

This description and the figure are based on the specimen of this species which Mr. Ellis retained when he sent other specimens to M. C. Cooke for a description. It will be seen that the dimensions and shape here given differ considerably from the one figured in Grevillea. The type is at Kew (2715 Cke.), and through the kindness of Mr. E. S. Salmon, it was possible to compare some of the spores and capillitium which agree in all respects with the original here, but the Kew specimens are apparently not so mature.

## 9. TYLOSTOMA CAMPESTRE Morg. Jour. Cin. Soc. Nat. Hist.

12: 163. *pl.* 16. *f.* 4. 1890

Peridium subglobose, 1–1.5 cm. high, 1–2 cm. in diameter: outer peridium brown, scaly, retreating and leaving an irregular ring around the lower part of the smooth inner peridium: collar irregular, descending about the top of the stem: mouth plane, lacerate, in some specimens being a mere crack or slit: stem rather thick, 3–10 cm. long, 1–1.5 cm. in diameter, darker than the peridium, fibrillose stuffed, becoming hollow, outer brownish coat lacerate, scaly, and having a small thickened mycelial bulb: capillitium yellowish, hyaline, cylindrical, 4–8  $\mu$  wide, branched, septate, somewhat swollen at the septa: spores subglobose, warty, some short pedicled, 3–5  $\mu$  wide. (Pl. 33, f. 10–12.)

EXSICC: E. & E. N. A. Fungi, 3297 (as *T. granulosum* Sw.?), 3514.

NEBRASKA: *Webber, Bates*; CALIFORNIA: *Underwood, McClatchie*; COLORADO, *Crandall*. Growing singly and in groups in sandy soil.

## 10. TYLOSTOMA EXASPERATUM Mont. Ann. Sci. Nat. II. 8: 362.

1837

Peridium subglobose, 1.2 cm. high, 1.3 cm. in diameter: outer peridium composed of long spinulose scales, somewhat reflexed, which recede from the top downward, leaving the brown inner peridium marked with a series of regular pits: mouth raised, fimbriate lacerate, rather large: collar inconspicuous: stem equal, slightly enlarged at the base, 5–7 mm. in diameter, 3.5 cm. long, covered with reflexed lacerate scales, like those on the outer peridium: dark brown: capillitium whitish-yellow, hyaline, 4–6  $\mu$  wide, branched, free ends rounded, sparingly septate, not much swollen at the joints: spores globose, furnished with long blunt spinules, 5–8  $\mu$  in diameter. (Pl. 33, f. 1–3.)

CUBA, *Wright*.

11. *Tylostoma tuberculatum* sp. nov.

Peridium depressed globose, 1–1.2 cm. high, 1–1.8 cm. in diameter: outer peridium scaly, retreating, leaving a wide band around the base of the whitish, smooth, and rather thin, inner peridium: mouth raised, fimbriate, roundish: collar close, inconspicuous: stem slender, whitish, hollow or stuffed, slightly enlarged at the base, 2–3 cm. long, 3 mm. in diameter: capillitium light yellow, hyaline, branched, thick-walled, variable as to width, 4–8  $\mu$  wide, rather flattened, ends rounded, broad, sparingly sep-

tate, swollen at joints: spores subglobose, nearly smooth or with occasional tuber-like warts, thick-walled,  $3-5\ \mu$  in diameter. (Pl. 33, f. 7-9.)

BRITISH COLUMBIA: *Macoun* (type); COLORADO: Fort Collins, *Baker*, 405.

12. ***Tylostoma fibrillosum*** sp. nov.

Peridium globose, 1-2 cm. high, 1-2.5 cm. in diameter: outer peridium retreating leaving a smooth whitish surface to the thin, membranaceous inner peridium, and leaving a thick portion round the base of the peridium forming a ring: collar indistinct, close: mouth raised, fimbriate, roundish: stem equal or slightly tapering toward the base, sulcate, firm, white and slimy within and without, somewhat hollow, fibrillose stuffed, and having a small thickened bulb which in some specimens falls off leaving a flat, whitish surface to the base of the stem, 5-7 cm. long, 5 mm. in diameter: capillitium whitish, hyaline,  $4-8\ \mu$  wide, branched, some threads rather thickened walled, sparingly septate, not much swollen at the joints, rather flattened: spores subglobose, minutely warted, darker than the capillitium, some short pediceled,  $3-5\ \mu$  in diameter. (Pl. 33, f. 4-6.)

ONTARIO: *Dearness* (type); MICHIGAN, *Hicks*. Growing on sand dunes.

The stem is much covered usually for upwards of 2 cm. with the mycelial strands, and adhering sand. The specimens from Michigan have rather more swollen septa.

13. ***Tylostoma subfuscum*** sp. nov.

Peridium globose, 0.8-1.3 cm. high, 1-1.5 cm. in diameter: outer peridium scaly, retreating, leaving a ring around the base of the smooth, brownish inner peridium: mouth raised, fimbriate: collar inconspicuous, close: stem brown, somewhat lacerate scaly, leathery, sulcate, with a small thickened bulb at the base, 2-3 cm. long, 3-5 mm. in diameter; capillitium lightish yellow, hyaline, branched, threads long and slender,  $4-6\ \mu$  wide, free ends rounded, occasionally septate, somewhat swollen at the joints: spores subglobose, minutely warted, some short pediceled,  $3-5\ \mu$  in diameter. (Pl. 34, f. 10-12.)

COLORADO, *Bethel*, 21.

14. TYLOSTOMA FIMBRIATUM Fries, Syst. Myc. 3: 43. 1829

Peridium subglobose, 1-1.5 cm. high, 1-1.5 cm. in diameter: outer peridium retreating, having a smooth, brownish surface to



the thin inner peridium: mouth raised, fimbriate, collar irregular, inconspicuous, close: stem white within and fibrillose stuffed, brownish and lacerate scaly outside, with a small mycelial bulb at the base, 1.5–5 cm. long, 5 mm. in diameter: capillitium light-colored, almost white, hyaline, freely septate, swollen at the joints, 4–8  $\mu$  wide: spores subglobose, dark ferruginous, verrucose, some short pediceled, 3–6  $\mu$  in diameter. (Pl. 34, f. 7–9.)

EXSICC.: Ravenel, *Fungi Car. Ex.* 5: 80; Ravenel, *Fungi Am. Ex.* 724.

NEW YORK, *Peck*; SOUTH CAROLINA, Ravenel; NORTH CAROLINA, *Curtis, Wood*; ALABAMA, *Earle*; TEXAS, *Wright*; WYOMING, *Nelson*; NEW MEXICO, *Wright*; COLORADO, *Cockerell*; KANSAS, *Kellerman*.

15. TYLOSTOMA PUNCTATUM Peck, Bull. Torr. Club, 23: 419. 1896

Peridium subglobose, 1–1.3 cm. high, 1–1.3 cm. in diameter: outer peridium scaly, retreating, leaving a ring around the base of the peridium: inner peridium thin, whitish, covered with irregular shallow pits: mouth raised, lacerate, irregular, rather large: collar indistinct, close: stem equal, darker than the peridium, lacerate scaly, with a small mycelial bulb, white within, hollow or stuffed, 2–3 cm. long, 3 mm. in diameter: capillitium whitish, hyaline, branched, septate, much swollen at the joints, 4–8  $\mu$  wide: spores subglobose, yellowish cinnamon-colored, minutely verrucose, some short pediceled, 3–5  $\mu$  in diameter. (Pl. 34, f. 1–3.)

KANSAS, *Bartholomew*; NEBRASKA, *Webber*; WASHINGTON, D. C., *Braendle*. Growing in sandy pasture land.

SPECIES NOT SEEN

16. TYLOSTOMA SEMISULCATUM Peck, Bull. Torr. Club, 22: 209. 1895

“Peridium subglobose, usually a little longer than broad, 6–8 lines broad, 9 lines long, glabrous above, ferruginous-tomentose on the lower half: osteolum entire: stem equal, about 2 inches long, even and glabrous or but slightly furfuraceous on the upper part, the lower part longitudinally sulcate, whitish: spores ferruginous, globose, .00016 to .0002 in. broad: threads of the capillitium not septate.

“Sandy soil, Nevada. Collected by C. W. Irish, communicated by T. Taylor.

“This species is separated from *T. mammosum* Fr. by its peri-

dium, which is tomentose on the lower half and not depressed, and by its stem which is distinctly furrowed on the lower half."

As this species was not seen the above original description is quoted. The same is the case with the following description of *T. Wrightii*, and the species which Morgan calls "*T. Meyenianum*." It has been thought best to include these descriptions in order that our present knowledge of the group may be accessible in a single paper.

17. TYLOSTOMA WRIGHTII Berk. Grevillea, **19**: 95. 1891

"Stem 6 cm. high, 4 mm. thick, hollow, equal, ochraceous, even, glabrous; peridium spherico-depressed, 2 cm. broad, minutely umbonate, pale, ochraceous, glabrous, the wall of the umbo disappears at maturity and forms a small circular stoma; mass of spores yellowish brown; threads of capillitium hyaline, thick-walled, aseptate, equal, very long, branched, axis lunate, 5  $\mu$  in diameter: spores glabrous, globose, pale yellow brown, minutely warted, 5-6  $\mu$  in diameter.

"On the ground. Rio Grande, North \* Mexico (Wright). Type in Herb. Berk.

"Distinguished from *Tylostoma Meyenianum* in the entire mouth and the hollow, even and not striated stem."

TYLOSTOMA sp. (Described by Morgan, Jour. Cin. Soc. Nat. Hist. **12**: 163. *pl.* 16. *f.* 5, as *T. Meyenianum* Kl., but it is clearly distinct from that species, though it might possibly be referred to *T. obesum* C. & E.)

"Peridium depressed, globose; the cortex soon receding, leaving a smooth whitish or yellowish surface to the submembranaceous inner peridium, the apex plane with a lacerate mouth: stipe long, thick, unequal, fusiform or tapering, nearly solid, sulcate: threads of the capillitium long, much thicker than the spores, branched, hyaline: spores subglobose, even, pale brown, 4.5-5.5 mic. in diameter.

"Growing in sandy soil. New Mexico, *Wright*; Colorado, *Webber*. Plant 2-4 inches in height, the peridium  $\frac{3}{4}$ -1 inch in diameter, the stipe about  $\frac{1}{2}$  of an inch in thickness at the thickest part. Specimens referred to *T. Angolense* W. & C. do not differ otherwise than in having the stipe thickest at the apex and taper-

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\* Probably a misprint for *New* as Wright was not known to have collected across the Rio Grande.

ing downward instead of fusiform. *T. obesum* C. & E. appears to be founded on a specimen with the short thick stipe not fully developed."

Morgan's description was made solely from Webber's Colorado specimen which was returned to Mr. Webber who is now unable to find it. The New Mexican reference is merely a quotation from Berkeley who determined Wright's original specimens under this name.

The following tabulation will give more compactly our present knowledge of the distribution of *Tylostoma* in North America :

TYLOSTOMA.	New York.	New Jersey.	Pennsylvania.	N. Carolina.	S. Carolina.	Alabama.	Florida.	Texas.	New Mexico.	Arizona.	California.	Nevada.	Colorado.	Nebraska.	Wyoming.	Michigan.	Iowa.	Wisconsin.	Ohio.	Kansas.	Indiana.	Canada.	Cuba.	Mexico.
albicans.								+			+		+	+										
campestre.																								
exasperatum.																								
fibrillosum.																								
fimbriatum.	+			+	+	+		+	+				+		+					+		+		
gracile.									+															
Kansense.																				+				
minutum.																				+				
obesum.																				+				
pedunculatum.	+	+	+	+			+	+	+	+			+	+		+	+	+		+	+			+
poculatum.						+							+	+	+									
punctatum.																				+				
semisulcatum.												+												
subfuscum.													+											
tuberculatum.													+									+		
verrucosum.																			+					
Wrightii.									+															

## II. CHLAMYDOPUS Speg. An. Mus. Nac. Buenos Aires, 6 : 189. pl. 4. f. 2, 3. 1899

In describing this genus Spegazzini includes two species from Argentina, *C. clavatus*, from which we cannot separate our New Mexican material, and *C. Amblaiensis* with a distinct annulus (?), and up to the present no other species of this genus have been reported. It is evident, however, from the description and figure of *Tylostoma Meyenianum* Kl.\* that that species, also, belongs to the genus *Chlamydopus*. While the figure shows no trace of a volva, its tapering stem with its broad attachment to the peridium, together with its general habit would seem to indicate its relationship to

\* Nov. Act. Caes. Leop. Carol. Nat. Cur. 19 : 243. pl. 5. f. 4. 1843.

this genus. The volva is of such a friable nature that it would be preserved with difficulty even if the stem had not been detached by the inattentive collector. Quite recently several specimens have been found at Mesilla Park, New Mexico, which belong here. In going over the material referred to *Tylostoma*, in the Ellis collection, two other specimens, from different localities in New Mexico, were found which though destitute of volva, evidently belong to the genus *Chlamydopus* though they may constitute another species. For the present they have been placed with *C. clavatus*.

I. CHLAMYDOPUS CLAVATUS Speg. *loc. cit.*

Peridium depressed globose, 1.5–2 cm. high, 2.2–3.5 cm. in diameter, smooth, leathery, lightish fawn-colored: mouth plane, lacerate, irregular: stem 8–15 cm. long, much enlarged at the top where it joins the peridium, 1.5–3 cm. in diameter at the top, 0.5–1.5 cm. at the base, sulcate, lacerate scaly, firm, solid, of the same color within and without as the peridium: volva friable, cup-like, with flaring sides, 1.5–2.5 cm. high, having remnants of earth and sand adhering to it: capillitium very abundant, interlaced, lightish yellow, hyaline, branched, sparingly septate, not swollen at the joints, the free ends usually rounded, 5–7  $\mu$  wide: spores subglobose, dark ferruginous, densely verrucose, 4–6  $\mu$  in diameter. (Pl. 35, f. 1–6.)

NEW MEXICO: Mesilla Park, *Cockerell*, Mesa, *Garcia*, Las Cruces, *Wooton*. Sandy soil under mesquite.

Aside from its technical characters this species presents a habit very unlike any species of *Tylostoma* found in this country. Its clean smoothish peridium and stem are quite in contrast with the usual condition found in the species of *Tylostoma*, where the rough outer peridium, and usually the stem also, is frequently covered with fragments of adhering soil. Also in the specimens of this genus, the capillitium threads are not as distinct as those of *Tylostoma* and have considerable white amorphous hyaline tissue intermingled with them.

III. BATTARREA Persoon,\* Syn. Meth. Fung. 129. *pl.* 3. f. 1–3. 1801

It has been impossible to trace the history of *Battarrea* to its very beginning as the *Acta Anglica*, in which Woodward makes

\* This genus was named for Antonio Battarra, an early Italian mycologist, and was first erroneously spelled *Batarrea* by Persoon. In 1804 the name was changed by Palisot de Beauvais to *Battarea*, but the correct spelling, *Battarrea*, was not adopted until 1825 by Fries.

first mention and gives the first drawing of this plant, has been inaccessible, but as early as 1785 Dickson\* described *Lycoperdon phalloides*—"volvulatum stipilatum, pileo deflexo campanulato; supra pulverulento calyptrato, infra glabro libero"—which unquestionably was the original *Battarrea*. It was collected in September by D. Humphreys and T. Woodward at Norwich, Norfolk and Bungay, Suffolk, England. In 1801, Persoon established the genus, and named and figured one species, *B. phalloides*, which he describes as follows—"volulata stipitata, Pileus deflexus, campanulatus, villosus, pulueris strato obsitus, a volua calyptratus." In 1814 Liboschitz† made the next mention, when he described a plant which he named *Dendromyces Stevenii*, from the river Volga, which Fries in 1839 referred to *Battarrea*. De Toni‡ gives eight species, and Fischer§ mentions seven of these, while quite lately, in 1899, Spegazzini|| described two new species from Argentina, making the number of described species ten in all.

The first *Battarrea* reported in this country was *B. phalloides*\*\* in 1873, said to have been collected by J. Torrey in the vicinity of San Francisco, Cal., but strangely enough, though this is the well-known European species, it has never since been found, to my knowledge, in the United States. Owing to the lack of description of the plant mentioned there is a question as to whether this plant really belongs to the species indicated. The only other species so far known in this country are *B. attenuata* from Nevada, described by Professor C. H. Peck†† in 1895, and *B. Diguetti*, described in the following year by M. Patouillard‡‡ from Lower California. Lastly some material has been sent to Professor L. M. Underwood from New Mexico and Arizona which proves to belong to two undescribed species.

A list of the hitherto known species with their localities is added:

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\* Plant. Crypt. Brit. 1: 24. 1785.

† Beschreibung eines neu entdeckten Pilzes. 1814.

‡ Saccardo, Syll. Fung. 7: 65; 9: 270; 14: 260.

§ Engler & Prantl, Die nat. Pflanzenfam. 11\*\* : 344. 1900.

|| An. Mus. Nac. Buenos Aires 6: 190, 191. 1899.

\*\* Grevillea 2: 35. 1873.

†† Bull. Torr. Club, 22: 208. 1895.

‡‡ Jour. de Bot. 10: 251. f. 2. 1886.

- B. PHALLOIDES Pers. England, Italy, North America (?).  
 B. GAUDICHAUDII Mont. Peru.  
 B. GUICCIARDINIANA Ces. Italy.  
 B. TEPPERIANA Ludw. Australia.  
 B. STEVENII (Libosch.) Fries. Siberia.  
 B. DIGUETI Pat. & Har. North America.  
 B. ATTENUATA Peck. North America.  
 B. MUELLERI Kalchbr. Australia.  
 B. GUACHIPARUM Speg. Argentina.  
 B. PATAGONICA Speg. Argentina.

#### Synopsis of the North American Species

Stem hollow.

Plants more than 20 cm. high; volva double, the inner layers split into numerous leaves.

1. *B. laciniata*.

Plants 20 cm. high or less.

Spores minutely verrucose; volva simple.

2. *B. Griffithsii*.

Spores nearly smooth; volva triple.

3. *B. Digueti*.

Stem solid.

4. *B. attenuata*.

#### 1. *Battarrea laciniata* Underwood, sp. nov.

Peridium 5–6 cm. in diameter, 2–3 cm. high, smooth, membranaceous, the upper portion sometimes having portions of the outer coat of the volva adhering to it: the lower portion after the spores have been shed is a yellowish-white and shows traces of where the capillitium has sprung: stem 25–35 cm. long, woody, hollow, stuffed with silky, thread-like fibers running about half way down the center of the stem, outer coat fibrous, peeling, sometimes merely lacerate, at others shaggy, slightly tapering to the base, about 2.5 cm. at the top and 1.5 cm. at the base: volva complex, composed of a thick outer coating, and an inner set of very numerous thin leaflets arranged more or less in layers about the stem: capillitium whitish, hyaline, indefinite, irregular, somewhat fascicular: cells 30–50  $\mu$  long, 5–7  $\mu$  wide, with raised annular thickenings or nearly flat spiral markings: spores subglobose, reddish-brown, 5–7  $\mu$  in diameter, almost smooth. (Pl. 36, f. 1–6.)

NEW MEXICO: Mesilla Park, *Cockerell*.

This plant resembles *B. Digueti* in some of its characters, but it is distinguishable (1) By its much larger size, (2) By its having no inner woody volva enclosing the lower portion of the stem, (3) In the much larger number of leaflets which compose the inner portion of the volva, and (4) In the different coloring and marking

of the cells. The plants vary considerably as to size and roughness of the stem.

2. **Battarrea Griffithsii** Underwood, sp. nov.

Peridium 2–3.5 cm. in diameter, 1–2 cm. high, smooth, membranaceous, lower part flat, showing the line of dehiscence distinctly: stem hollow, equal, 1–1.5 cm. in diameter, 9.5–15 cm. long, sulcate, peeling fibrillose: volva fairly well marked, composed of a few appressed fibrillose blunt squamules: capillitium 4–10  $\mu$  wide, whitish, flattened, rather amorphous, branched, and having a large number of cells mixed with it: cells darker than the capillitium, with spiral markings and annular thickenings, 6–8  $\mu$  wide, 24–85  $\mu$  long: spores subglobose, minutely verrucose, looking smooth except under very high magnification, reddish-cinnamon colored, 4–5  $\mu$  in diameter. (Pl. 37, f. 1–6.)

ARIZONA, *David Griffiths*, to whom the species is dedicated.

3. **BATTARREA DIGUETI** Pat. & Har. Jour. de Bot. **10**: 251. *pl.*  
2. f. 1–6. 1896

Peridium depressed globose, membranaceous: stem 15–20 cm. long, 8–10 mm. wide: spores globose, ferruginous, 5–6  $\mu$  in diameter: cells 100–150  $\mu$  long, 4–7  $\mu$  wide, with darker yellow annular markings: volva of three layers, the outer one woody, simple, whitish, the inner woody and simple, and encircling the lower third part of the stem, the third layer between the outer and inner volva is composed of from 10 to 20 thin membranaceous leaflets.

LOWER CALIFORNIA, *Diguet*. In barren rocky soil.

No specimens of this species have been seen, but it has been thought best to quote the above partial translation of M. Patouillard's very full description.

4. **BATTARREA ATTENUATA** Peck, Bull. Torr. Club, **22**: 208. 1895

"Exoperidium unknown: endoperidium 2 in. or more in breadth, the basal part hard, thick, even and concave beneath, convex above, and somewhat coarsely reticulated by the bounding walls of broad shallow pits: stem 8 to 10 in. long, gradually attenuated toward the base, hard, almost woody, solid, rough except at the top, with rather coarse spreading or reflexed scales, brown externally, rusty brown within: spores globose, ferruginous, .0003 in. broad: threads of the capillitium destitute of spiral thickenings.

"Plant commonly growing in tufts of 3–5 individuals. Dry sandy soil. Nevada. Collected by C. W. Irish; communicated by Dr. Thomas Taylor."

The single specimen of this species known is at Albany and is inaccessible at the present time, so the above original description has been quoted verbatim.

IV. QUELETIA Fries. Öfversigt Kongl. Vetens. Akad. Förhandlingar, Stockholm, 171. *pl.* 4. 1871

This genus was established on a single species, and as yet no others are known. It is very rare, having been reported from very few localities. It was discovered by Dr. L. Quelet, at Herimncourt, France, and has since been reported from the environs of Rouen (Saint-Saens), and Pont de Sochaux, France. It has been found only once in the United States, at Trexlertown, Penn., by Mr. William Herbst, and was reported by Professor C. H. Peck, in his 46th report of the State Botanist. He is of the opinion that this plant was introduced into this country in some way with tan bark, on which it usually grows.

I. QUELETIA MIRABILIS Fries, *loc. cit.*

Peridium globose, 2.5–3.5 cm. high, 3–4 cm. in diameter, fragile, easily separating from the stem, rupturing irregularly, of a reddish-brown color: collar irregular, of the same substance as the peridium: stem 6.5–8 cm. long, 1.5 cm. wide at the top, 2 cm. at the base, fascicular, reddish-brown, within and without, like the peridium, solid, lacerate, fibrillose, particularly at the base: capillitium very abundant and interwoven, forming with the spores a felt-like mass, reddish-brown, single threads whitish-yellow, thick-walled, hollow as shown by the truncated ends, septa rare or wanting, 5–9  $\mu$  wide, branches rather short, free ends rounded and recurved: spores subglobose, coarsely warted, 4–6  $\mu$  in diameter, some short-pediceled, inner portion breaking up and issuing from the thin-warted coating which is then hyaline and shrivelled. (Pl. 38, f. 1–5.)

PENNSYLVANIA: Trexlertown, *Herbst*. On spent tan bark. Summer, after rains, forming circles.

V. DICTYOCEPHALOS Underwood, gen. nov.

Plants with the irregularly rupturing peridium closely attached to the solid stem. Volva cup-like, persistent at the base of the stem. Gleba composed of a mesh-like irregular tissue, in which the capillitium threads are embedded.



1. *Dictyocephalos curvatus* Underwood, sp. nov.

Outer peridium of a thick woody texture, bearing a definite cup-like volva at the base of the stem, the upper portion being carried up on the peridium, and either falling off or remaining adherent to it : inner peridium scleroderma-like, rough, dark brown, scaly, rather flattened sideways, rupturing irregularly, 3–6 cm. high, 5–8 cm. in diameter : stem 25–40 cm. long, 3–6 cm. in diameter at the summit, 1.5–4 cm. in diameter at the base, considerably flattened, twisted, solid, dark brown within and without, sulcate, the outer surface very uneven, and peeling : the collar indistinct, formed by the lower portion of the peridium adhering to the top of the stem and becoming torn as the stem elongates : the top of the stem is rounded and projects into the peridium forming a pseudo-columella, of a yellowish-brown color, lighter than the rest of plant, marked with irregular, reticulated pits, from the sides of which the mesh-like tissue springs which forms with the spore mass the main part of the gleba : capillitium 8–10  $\mu$  wide, mostly embedded in the mesh-like tissue, bright yellow, cylindric, septate, not much swollen at the joints, branched, the free ends rounded : spores subglobose, warty, 5–7  $\mu$  in diameter. (Pl. 39, 40.)

COLORADO : Colorow, *Bethel*.

Plants with a strong odor which in the dry condition much resembles that of the dried bark of *Ulmus fulva*. The spores of these specimens first appeared to be of two kinds—darker warted, larger ones, and smaller, smooth, light colored ones—but it was soon seen that this was owing to the outer coat having been eaten off by the quantities of small insects by which these plants were infested.

These strange plants were found by Mr. E. Bethel at Colorow, Col., in the month of August, 1897. In the notes sent with these specimens to Mr. Ellis, Mr. Bethel says : " These plants are very odd-looking in their native haunts ; they grow on a soft alkaline adobe soil. Some of them had lifted themselves entirely out of the ground, while others had the stalk standing in about one inch of soil. They presented a very fantastic appearance, as there was little or no other vegetation about. \* \* \* Some of the specimens were very much bent, approximating a semicircle, others were twisted like a corkscrew, with the portions of the stalk split and bent back. I think the chief factor in lifting the plant out of the ground is this twisting and bending back of the portions of the stem during dessication."

**Explanation of Plates**

In most cases the drawings have been made twice natural size and reduced one half. The capillitium and spores were drawn with a camera lucida under double the magnification noted.

## PLATE 31

- FIG. 1. *Tylostoma pedunculatum*, nat. size.
- FIG. 2. Spores and capillitium,  $\times 170$ .
- FIG. 3. Spores,  $\times 310$ .
- FIG. 4, 5. *Tylostoma albicans*, nat. size.
- FIG. 6. Spores and capillitium,  $\times 170$ .
- FIG. 7. Spores,  $\times 310$ .
- FIG. 8. *Tylostoma verrucosum*, nat. size.
- FIG. 9. Spores and capillitium,  $\times 170$ .
- FIG. 10. Spores,  $\times 310$ .
- FIG. 11. *Tylostoma minutum*, nat. size.
- FIG. 12. Spores and capillitium,  $\times 170$ .
- FIG. 13. Spores,  $\times 310$ .

## PLATE 32

- FIG. 1. *Tylostoma gracile*, nat. size.
- FIG. 2. Spores and capillitium,  $\times 170$ .
- FIG. 3. Spores,  $\times 310$ .
- FIG. 4. *Tylostoma obesum*, nat. size.
- FIG. 5. Spores and capillitium,  $\times 170$ .
- FIG. 6. Spores,  $\times 310$ .
- FIG. 7. *Tylostoma Kansense*, nat. size.
- FIG. 8. Spores and capillitium,  $\times 170$ .
- FIG. 9. Spores,  $\times 310$ .

## PLATE 33

- FIG. 1. *Tylostoma exasperatum*, nat. size.
- FIG. 2. Spores and capillitium,  $\times 170$ .
- FIG. 3. Spores,  $\times 310$ .
- FIG. 4. *Tylostoma fibrillosum*, nat. size.
- FIG. 5. Spores and capillitium,  $\times 170$ .
- FIG. 6. Spores,  $\times 310$ .
- FIG. 7. *Tylostoma tuberculatum*, nat. size.
- FIG. 8. Spores and capillitium,  $\times 170$ .
- FIG. 9. Spores,  $\times 310$ .
- FIG. 10. *Tylostoma campestre*, nat. size.
- FIG. 11. Spores and capillitium,  $\times 170$ .
- FIG. 12. Spores,  $\times 310$ .

## PLATE 34

- FIG. 1. *Tylostoma punctatum*, nat. size.
- FIG. 2. Spores and capillitium,  $\times 170$ .
- FIG. 3. Spores,  $\times 310$ .
- FIG. 4. *Tylostoma poculatum*, nat. size.
- FIG. 5. Spores and capillitium,  $\times 170$ .
- FIG. 6. Spores,  $\times 310$ .

- FIG. 7. *Tylostoma fimbriatum*, nat. size.  
 FIG. 8. Spores and capillitium,  $\times 170$ .  
 FIG. 9. Spores,  $\times 310$ .  
 FIG. 10. *Tylostoma subfuscum*, nat. size.  
 FIG. 11. Spores and capillitium,  $\times 170$ .  
 FIG. 12. Spores,  $\times 310$ .

PLATE 35

- FIG. 1. *Chlamydopus clavatus*, nat. size.  
 FIG. 2. Spores and capillitium,  $\times 170$ .  
 FIG. 3. Spores,  $\times 310$ .  
 FIG. 4. Single spores,  $\times 450$ .  
 FIG. 5. Peridium showing lacerate mouth, and enlarged stem, nat. size.  
 FIG. 6. Section through peridium and stem.

PLATE 36

- FIG. 1. *Battarrea laciniata*,  $\frac{1}{2}$  nat. size.  
 FIG. 2. Spores and capillitium,  $\times 170$ .  
 FIG. 3. Spores,  $\times 310$ .  
 FIG. 4. Cells,  $\times 310$ .  
 FIG. 5. Cell after desiccation,  $\times 310$ .  
 FIG. 6. Peridium, nat. size, showing attachment to the stem.

PLATE 37

- FIG. 1. *Battarrea Griffithsii*, nat. size.  
 FIG. 2. Specimen showing under side of peridium, volva missing, nat. size.  
 FIG. 3. Peridium showing method of dehiscence, nat. size.  
 FIG. 4. Spores, capillitium and cells,  $\times 170$ .  
 FIG. 5. Spores,  $\times 310$ .  
 FIG. 6. Cells,  $\times 310$ .

PLATE 38

- FIG. 1. *Queletia mirabilis*, nat. size.  
 FIG. 2. Spores and capillitium,  $\times 170$ .  
 FIG. 3. Spores,  $\times 310$ .  
 FIG. 4. Spores, showing breaking up of inner substance,  $\times 310$ .  
 FIG. 5. Section through the peridium, showing detachment of stem, nat. size.

PLATE 39

- FIG. 1. *Dictyocephalos curvatus*,  $\frac{1}{2}$  nat. size.  
 FIG. 2. Lower portion of stem, and double volva,  $\frac{1}{2}$  nat. size.  
 FIG. 3. Peridium, ruptured irregularly, with remnants of mesh-like tissue,  $\frac{1}{2}$  nat. size.  
 FIG. 4. Portion of tissue with spores and capillitium embedded in it,  $\times 170$ .

PLATE 40

- FIG. 5. *Dictyocephalos curvatus*,  $\frac{3}{4}$  nat. size.  
 FIG. 6. Spore,  $\times 465$ .  
 FIG. 7. Inner portion of spore issuing from outer coat,  $\times 465$ .  
 FIG. 8. Empty, hyaline spore coats,  $\times 465$ .  
 FIG. 9. Smooth inner spores after issuing from outer coat,  $\times 465$ .